CLAIMS:

1. A method of making a lithography photomask blank, comprising the steps of:
providing a soot deposition surface,

producing a plurality of SiO_2 soot particles and projecting said SiO_2 soot particles towards said soot deposition surface,

successively depositing said SiO_2 soot particles on said deposition surface to form a coherent SiO_2 porous glass preform body,

dehydrating said coherent SiO_2 glass preform body to remove OH from said coherent SiO_2 glass preform body,

exposing said SiO_2 to a fluorine containing atmosphere and consolidating the coherent SiO_2 glass preform body into a silicon oxyfluoride glass body having less than 1×10^{17} H_2 molecules/cm^3,

forming said consolidated silicon oxyfluoride glass body into a photomask blank having less than 1×10^{17} H_2 molecules/cm^3 and a planar surface.

2. A method as claimed in claim 1, wherein providing a soot deposition surface includes providing a substrate, said substrate having a substrate initial deposition surface.

3. A method as claimed in claim 2, wherein said substrate initial deposition surface is curved.

4. A method as claimed in claim 2, wherein said substrate initial deposition surface is a flat planar surface.

5. A method as claimed in claim 1, wherein producing and projecting SiO_2 soot particles includes providing a SiO_2 soot deposition burner which produces a conversion site flame, feeding a SiO_2 feedstock to the burner wherein said flame converts said feedstock into a SiO_2 soot particle stream aimed at said deposition surface.

6. A method as claimed in claim 5, wherein producing and projecting said SiO_2 soot particles and successively depositing said SiO_2 soot particles further includes providing relative motion between said burner and said soot deposition surface.

7. A method as claimed in claim 1, the step of successively depositing said soot particles to form a coherent porous glass preform further includes depositing said soot particles by thermophoresis at a soot deposition temperature and with a soot deposition size wherein said deposited soot particles are bonded together to form said coherent porous glass preform body.

8. A method as claimed in claim 1, wherein dehydrating further includes, exposing said coherent SiO_2 glass preform body to a heated halide containing atmosphere.

9. A method as claimed in claim 8, wherein said heated halide containing atmosphere is comprised of helium and chlorine.

10. A method as claimed in claim 8, wherein said heated halide containing atmosphere includes fluorine.

11. A method as claimed in claim 1, wherein exposing said preform body to said fluorine containing atmosphere and consolidating the preform body into a silicon oxyfluoride glass body includes replacing a plurality of silicon to oxygen bonds with a plurality of silicon to fluorine bonds.

12. A method as claimed in claim 1, wherein said fluorine containing atmosphere includes SiF_4.

13. A method as claimed in claim 1, wherein said fluorine containing atmosphere includes CF_4.

14. A method as claimed in claim 1, wherein said fluorine containing atmosphere includes C_2F_6.

15. A method as claimed in claim 1, wherein said fluorine containing atmosphere includes SF_6.

16. A method as claimed in claim 1, wherein exposing said SiO_2 to a fluorine containing atmosphere comprises exposing said SiO_2 to a fluorine source compound concurrent with producing said SiO_2 soot particles and projecting said SiO_2 soot particles.

17. A method as claimed in claim 16, further comprising exposing said coherent SiO_2 porous glass preform body to a fluorine containing atmosphere.

18. A method as claimed in claim 1, wherein said fluorine containing atmosphere includes helium.

19. A method as claimed in claim 1, wherein OH is first removed by dehydrating and fluorine is incorporated into the dehydrated SiO_2 soot and consolidated into said silicon oxyfluoride glass body with said glass containing at least 0.5 wt. % F.

20. A method as claimed in claim 1, wherein said consolidated silicon oxyfluoride glass consists essentially of Si, O, and F.

21. A method as claimed in claim 1, wherein said consolidated silicon oxyfluoride glass has a F wt. % concentrated ranging from .5 to 3 wt. % and has an OH content less than 10 ppm.

22. A method as claimed in claim 1, wherein dehydrating includes heating the preform body to a temperature in the range from 900 to 1100° C in a dehydrating atmosphere, and exposing to said fluorine containing body and consolidating into a silicon oxyfluoride glass includes heating the dehydrated preform body to a temperature in the range from 1125 to 1325° C in an atmosphere containing F, and then sintering said preform body at a temperature in the range from 1350° C to 1550° C.

23. A method as claimed in claim 1, wherein forming said consolidated silicon oxyfluoride glass body into a photomask blank having a planar surface further includes polishing said silicon oxyfluoride glass body.

24. A method as claimed in claim 1, further comprising transmitting 157 nm wavelength light through said formed photomask blank planar surface.

25. A method as claimed in claim 1, further comprising forming a lithographic image pattern on said photomask blank planar surface.

26. A method as claimed in claim 25, further comprising impinging light including the 157 nm wavelength towards said photomask blank planar surface to form a projection image pattern and projecting the projection image pattern onto a radiation sensitive material.

27. A method of making a lithography photomask blank having a photomask blank large dimension L and a photomask blank thickness T comprising the steps of:

providing a coherent SiO_2 porous glass preform column,

dehydrating said coherent SiO_2 porous preform column to remove OH from said coherent SiO_2 glass preform column,

exposing said SiO_2 to a fluorine containing atmosphere and consolidating the coherent SiO_2 glass preform column into a consolidated silicon oxyfluoride glass having less than 1×10^{17} H_2 molecules/cm^3,

forming said silicon oxyfluoride glass into a photomask blank having less than 1×10^{17} H_2 molecules/cm^3 and a planar surface.

28. A method as claimed in claim 27, wherein consolidating and providing said SiO_2 porous glass preform column further includes consolidating the preform column into a consolidated silicon oxyfluoride glass column having a column height CH and a column diameter CD, wherein $(CD)^2\, CH \geq L^2\, T$.

29. A method as claimed in claim 28, wherein said silicon oxyfluoride glass has a diameter greater than L and a thickness greater than T.

30. A method as claimed in claim 29, wherein said diameter is greater than $\sqrt{2}$ L.

31. A method as claimed in claim 28, wherein said SiO_2 porous glass preform column has a preform height PH and a preform diameter PD, with $PH(PD)^2 \approx 8(CD)^2$ CH.

32. A method as claimed in claim 28, said method including heating said glass column to a flow temperature in the range from 1800 to 2300° C.

33. A method as claimed in claim 32, wherein heating said glass column includes applying a force to the glass column.

34. A method as claimed in 27, wherein said silicon oxyfluoride glass consists essentially of Si, O, and F.

35. A method as claimed in 27, wherein said silicon oxyfluoride glass has an OH content ≤ 10 ppm and a F wt. % of at least .5wt.%.

36. A method of making a lithography photomask blank having a photomask blank large dimension L and a photomask blank thickness T comprising the steps of:

providing a cylindrical coherent SiO_2 porous glass preform column comprised of a plurality of SiO_2 soot particles,

dehydrating said coherent SiO_2 porous glass preform column to remove OH from said coherent SiO_2 glass preform column,

exposing said coherent SiO_2 glass preform column to a fluorine containing atmosphere and consolidating the coherent SiO_2 glass preform column into a consolidated silicon oxyfluoride glass column having less than 1×10^{17} H_2 molecules/cm^3 and forming said consolidated silicon oxyfluoride glass column into a photomask blank having a planar surface.

37. A method as claimed in claim 36, wherein said consolidated silicon oxyfluoride glass column has a column height CH and a column radius CR wherein $CR \geq L/2$ and $CH \geq T$.

38. A method as claimed in claim 37, wherein $CR \geq (\sqrt{2})L/2$.

39. A method as claimed in claim 37, wherein said SiO_2 porous glass preform column has a preform height PH and a preform diameter PD, with $PH(PD)^2 \geq 8CH(CR)^2$.

40. A method as claimed in 36, wherein said silicon oxyfluoride glass consists essentially of Si, O, and F.

41. A method as claimed in claim 36, wherein said silicon oxyfluoride glass has an OH content ≤ 10 ppm and a F wt. % ≥ .5 wt. %.

42. A glass lithography mask blank consolidated preform comprising a silicon oxyfluoride glass column having an OH content ≤ 10 ppm, a F wt. % concentration ≥ .5 wt. %, said silicon oxyfluoride glass column having less than 1×10^{17} H_2 molecules/cm^3.

43. A mask blank preform as claimed in claim 42, wherein said silicon oxyfluoride glass consists essentially of Si, O, and F.

44. A mask blank preform as claimed in claim 42, wherein said silicon oxyfluoride glass has a fluorine content in the range from .5 to 3 wt. % F.

45. A mask blank preform as claimed in 43, wherein said silicon oxyfluoride glass has a molecular H_2 content of less than 5×10^{16} molecules/cm^3.

46. A mask blank preform as claimed in 43, wherein said silicon oxyfluoride glass has a chlorine content less than 10 ppm.

47. A mask blank preform as claimed in claim 42, wherein said silicon oxyfluoride glass has a 157 nm light transmission percentage of at least 70% per 5 mm thickness of glass.

48. A mask blank preform as claimed in claim 42, wherein said silicon oxyfluoride glass column is free of inclusions having a dimension > 1 μm.

49. A glass lithography mask blank consolidated preform for forming a lithography mask blank having a mask blank large dimension L and a mask blank thickness T, said mask blank preform comprising a silicon oxyfluoride glass column having less than 1×10^{17} H_2 molecules/cm^3 and a column height CH and a column diameter CD, wherein $(CD)^2\ CH \geq L^2T$.

50. A glass mask blank preform as claimed in claim 49, wherein said silicon oxyfluoride glass has an OH content $\leq$ 10 ppm, and a F wt. % concentration $\geq$ .5 wt. %.

51. A glass mask blank preform as claimed in claim 49, wherein said silicon oxyfluoride glass consists essentially of Si, O, and F.

52. A glass mask blank preform as claimed in claim 49, wherein said silicon oxyfluoride glass has a fluorine content in the range from .5 to 3 wt. % F.

53. A glass mask blank preform as claimed in claim 49, wherein said silicon oxyfluoride glass has a molecular H_2 content of less than 5×10^{16} molecules/cm^3.

54. A glass mask blank preform as claimed in claim 49, wherein said silicon oxyfluoride glass has a chlorine content less than 10 ppm Cl.

55. A glass lithography mask blank formed from a glass lithography mask blank preform as claimed in claim 48, wherein said mask blank is comprised of a flat

planar glass member having a top planar surface, a bottom planar surface, a mask blank large dimension L and a mask blank thickness T.

56. A glass lithography mask blank consolidated preform for forming a lithography mask blank having a mask blank large dimension L and a mask blank thickness T, said mask blank preform comprising a silicon oxyfluoride glass column having less than 1×10^{17} H_2 molecules/cm^3 and said glass column having a column height CH and a column radius CR wherein $CR \geq L/2$ and $CH \geq T$.

57. A glass mask blank preform as claimed in claim 56, wherein said silicon oxyfluoride glass has an OH content ≤ 10 ppm, a F wt. % concentration ≥ .5 wt. %.

58. A glass mask blank preform as claimed in claim 56, wherein said silicon oxyfluoride glass consists essentially of Si, O, and F.

59. A glass mask blank preform as claimed in claim 56, wherein said silicon oxyfluoride glass has a fluorine content in the range from .5 to 3 wt. % F.

60. A glass mask blank preform as claimed in claim 56, wherein said silicon oxyfluoride glass has a molecular H_2 content of less than 5×10^{16} molecules/cm^3.

61. A glass mask blank preform as claimed in claim 56, wherein said silicon oxyfluoride glass has a chlorine content less than 10 ppm Cl.

62. A glass lithography mask blank formed from a glass lithography mask blank preform as claimed in claim 56, wherein said mask blank is comprised of a flat planar glass member having a top planar surface, a bottom planar surface, a mask blank large dimension L and a mask blank thickness T.

63. A lithography photomask blank comprising a flat planar silicon oxyfluoride glass member having a top planar surface and a bottom planar surface, said planar silicon oxyfluoride glass member having an OH content ≤ 10 ppm, a F wt. %

concentration ≥ .5 wt. %, said silicon oxyfluoride glass having less than 1×10^{17} H_2 molecules/cm^3 and said top planar surface has a surface roughness ≤ 0.15 nm rms.

64. A lithography photomask blank as claimed in claim 63, wherein said planar silicon oxyfluoride glass member has a 157 nm light transmission percentage of at least 70% per 5 mm thickness of glass.

65. A lithography photomask blank as claimed in claim 63, wherein said silicon oxyfluoride glass consists essentially of Si, O, and F.

66. A lithography photomask blank as claimed in claim 63, wherein said silicon oxyfluoride glass has a F wt. % content in the range from .5 wt. % to 3 wt. %.

67. A lithography photomask blank as claimed in claim 63, wherein said flat planar silicon oxyfluoride glass member has a transmission uniformity at 157 nm in the range from –2% to +2%.

68. A lithography photomask blank as claimed in claim 63, wherein said silicon oxyfluoride glass member is free of inclusions having a dimension > 1 μm.

69. A lithography photomask blank as claimed in claim 63, wherein said silicon oxyfluoride glass member has a birefringence ≤ 5 nm/cm.

70. A lithography photomask blank claimed in claim 63, wherein said flat planar silicon oxyfluoride glass member has a thickness of at least .6 cm, a length of at least 15 cm, is free of inclusions having a dimension > 1 μm, a transmission uniformity at 157 nm in the range from –2 to +2%, transmission at 157 nm > 70%, and a birefringence ≤ 5 nm/cm.

71. A method as claimed in claim 1, wherein said silicon oxyfluoride glass body has less than 5×10^{16} H_2 molecules/cm^3.

72. A method as claimed in claim 1, wherein said silicon oxyfluoride glass body has no detectable hydrogen.

73. A method as claimed in claim 27, wherein said silicon oxyfluoride glass column has less than 5×10^{16} H_2 molecules/cm^3.

74. A method as claimed in claim 27, wherein said silicon oxyfluoride glass column has no detectable hydrogen.

75. A method as claimed in claim 36, wherein said silicon oxyfluoride glass column has less than 5×10^{16} H_2 molecules/cm^3.

76. A method as claimed in claim 36, wherein said silicon oxyfluoride glass column has no detectable hydrogen.

77. A preform as claimed in claim 42, wherein said silicon oxyfluoride glass column has no detectable hydrogen.

78. A preform as claimed in claim 49, wherein said silicon oxyfluoride glass column has no detectable hydrogen.

79. A preform as claimed in claim 56, wherein said silicon oxyfluoride glass column has no detectable hydrogen.

80. A photomask blank as claimed in claim 65, wherein said silicon oxyfluoride glass has less than 5×10^{16} H_2 molecules/cm^3.

81. A photomask blank as claimed in claim 65, wherein said silicon oxyfluoride glass has no detectable hydrogen.